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Favourable and Unfavourable EMF Frequency Patterns in Cancer: Perspectives for Improved Therapy and Prevention

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Abstract

Carcinogenesis fits in a frequency pattern of electromagnetic field (EMF) waves, in which a gradual loss of cellular organization occurs. Such generation of cancer features can be inhibited by adequate exposure to coherent electromagnetic frequencies. However, cancer can also be initiated and promoted at other distinct frequencies of electromagnetic waves. Both observations were revealed by analyzing 100 different EMF frequency data reported in a meta-analyses of 123 different, earlier published, biomedical studies. The studied EM frequencies showed a fractal pattern of 12 beneficial (anti-cancer) frequencies, and 12 detrimental (cancer promoting) frequencies, that form the central pattern of a much wider self-similar EMF spectrum of cancer inhibiting or promoting activities. Inhibiting of the cancer process, and even curing of the disease, can thus be considered through exposure to the coherent type of EM fields. Stabilization of the disease can be understood by constructive resonance of macromolecules in the cancer cell with the externally applied coherent EMF field frequencies, called solitons/polarons. The latter, for instance, have been shown earlier to induce repair in DNA/RNA conformation and/or epigenetic changes. The field of EMF treatment of cancer disorders is rapidly expanding and our studies may invite further experimental and clinical studies in which systematically various potential EMF treatment protocols could be applied, with combined and modulated frequencies, to obtain even more efficient EMF anti-cancer therapies.

Keywords

Cancer Therapy, Coherent EMF Frequencies, Non-Coherent EMF Frequencies, Electromagnetic Fields, Solitons, Non-Ionizing EM Radiation, Fröhlich, Davydov

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1. Introduction

The present study was performed to provide a systematic overview of electromagnetic (EM) frequencies that influence cancer processes, through a meta-analysis of earlier scientific reports on the effects of EM fields on life systems *in vitro* and *in vivo*, in the framework of cancer experimentation. A second aim was to apply these data to further unravel the biomolecular and biophysical mechanisms that may play a role in this widespread group of diseases, with special reference to the role of a discovered semi-harmonic oscillatory wave pattern system of cellular macromolecules that determine a proper functional structure of the cell.

The entire list of relevant data out of the investigated literature can be found in **Appendix**, beneficial frequencies and detrimental frequencies, while further details of the experiments analyzed can be found in **Appendix 1**. Studies were included in the present meta-analyses on the basis of, mostly, peer reviewed articles, using well defined radiation technology and exposure characteristics, containing statistically significant and reproducible data as well as clearly description of the particular positive or negative effects. A, single glimpse, overview of the present results is depicted in **Figure 1**.

Fröhlich pioneered in this approach by proposing that the functionality in living systems results from ordered vibratory states influencing the apparently chaotic motions and arrangements of biological molecules. An important feature is that ordered or coherent states can be manifest over large distances, thus offering a mechanism by which cells can intercellular and intracellular communicate, in addition to the known short range chemical forces. This long-range biological coherence provides the growth control as it exists in healthy tissue but is absent in cancer [1]. A number of investigators have expanded Fröhlich's

Figure 1. Solitons propagate in either direction, exchange positions and eventually return the system to states that resemble their initial configuration. The motion of the solitons can be seen here by following the lines of colours, which denote displacements (From Porter, 2009 and image from Zabusky, Sun and Peng 2006).

concept, and aimed at testing the predicted conditions experimentally [2] [3]. Adey proposed a model by which weak EM signals could be transmitted through cell membranes and how solitary waves may carry weak signals inside cells. Preto provided a general classical Hamiltonian description of a nonlinear open system of biomolecular structures exhibiting multiple degrees of freedom, that can be excited by an external energy source. It was shown that a coherent behavior, similar to Fröhlich's effect, is to be expected for a given range of discrete parameter values [4]. Direct experimental support for the presence of Fröhlich condensation to coherent vibratory cell domains, and the related action in the arrangement of proteins, was found by spectroscopic detecting of Bose-Einstein condensate-like structures in biological matter at room temperature [5].

Coherence is defined as the physical congruence of wave properties within wave packets. It is a known property of stationary waves (*i.e.* temporally and spatially constant) that enables a type of wave interference, defined as constructive. Constructive wave interference leads to the generation of specific resonance patterns, promoting coherent cellular wave domains, and dynamic cell systems are partially operating via this principle. Coherence or non-randomness of quantum resonances has also been discussed by Einstein and Infield in 1961 for the so-called "prequantum modes". It was Schrödinger who recognized that coherent interaction of waves is coupled to entanglement as "the characteristic aspect of quantum mechanics" and suggested that "eigenstates", also called "preferred states" are able to survive interaction with the environment. Coherent resonances can be present in electrons, photons, phonons and quasi-paricles such as solitons. The preferred location for resonance transfer in living cells are the surrounding domains of ion water clathrates, nucleic acids and ion-protein complexes. Water molecule arrangements are known to be coherently nano-structured and the resulting coherent domains affect bio-molecular processes, including protein conformation and stability, substrate binding to enzymes, as well as electron and proton transfer [6] [7] [8]. Semikhina documented that alternating magnetic fields in the range 25 nT-879 μT are able to disrupt the arrangement of water molecules, particularly under high concentrations of hydrogen bonds and protons. The effects were absent above 40˚C - 50˚C, as water structure changes. The maximum effect was detected at 156.2-Hz and 15.45 μT for 7˚C pure water (of note: that value is very close to the some of the calculated non-coherent frequencies revealed in our life algorithm) [9] [10].

According to Henry two main regimes of aqueous solutions exist containing solutes species either as small ions or large colloids: 1) an incoherent regime when the concentration is not high enough to favor phase locking between matter, radiation and vacuum and 2) a coherent regime of phase locking between coherence domains, above a certain threshold of concentration, depending upon the nature of the added salts. The characteristic feature of his model is that the coupling between matter fields (water, ions, colloids) and the electromagnetic field, originating in the vacuum, is not zero as in classical theories [11].

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